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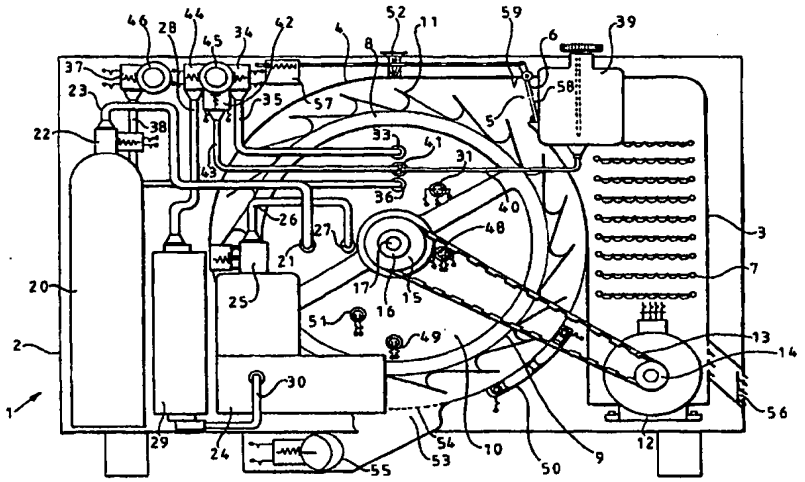

(57) Abstract

A kitchen appliance (1) comprises a casing (2) incorporating first and second chambers (3, 4) which are communicable by an air inlet (5). A heat source (7) in the first chamber (3) serves to produce a flow of heated air to be passed into the second chamber (4) through the air inlet (5). In addition, a rotary impeller in the form of a vaned drum (8) is provided in the second chamber (4), and a drive unit (12) is provided for rotating the drum (8) to draw heated air from the first chamber (3) into the second chamber (4) through the air inlet (5). The drum (8) has an apertured outer wall (9) surrounding an inner space for containing the food to be cooked or articles to be washed, as well as outwardly extending vanes (11), such that rotation of the drum (8) by the drive unit (12) causes heated air from the air inlet (5) to be drawn through the apertured outer wall (9) and into the inner space within the drum (8). Such an appliance provides a highly advantageous means of both cooking and washing.

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"Cooking and Washing Appliances"

This invention relates to appliances which are used for cooking or warming and/or washing or cleaning. Whilst such appliances will be referred to hereinafter as "kitchen appliances", it should be understood that the appliances are not limited to use in a kitchen environment but may be used in any application either in which cooking or heating is required or in which washing or cleaning is required, including cleaning applications encountered in a hospital or laboratory environment or in a manufacturing process.

Cooking is conventionally undertaken in an oven which is directly heated either by an electrical heater or by gas-firing, or in a pan placed on an electrically heated or gas-fired hob. Cooking on a hob is labour intensive as it requires regular supervision and subsequent washing of the pan. Furthermore it is dangerous to leave a pan warming on a hob unsupervised, particularly during frying, since the pan may become overheated or spill or boil dry with consequent risk of fire or explosion or injury. Where cooking is carried out commercially, particular attention must be paid to meeting the required health and safety requirements, and this can involve high cost in providing appropriate safety measures and in employing adequate staff to supervise cooking and to clean equipment. This can mean that many premises are limited in terms of the range of food which they can offer and the times for which they can offer food for sale. A conventional oven is also very limited in terms of the cooking processes which it can undertake and the degree of control of cooking which it permits.

Whether cooking is undertaken commercially or in the home, the quality of the cooked food can be seriously affected by the cooking process and by inadequate control of this process. During cooking in oil, it is easy for the quality of the food to be compromised due to breakdown of the oil during cooking or due to the food becoming saturated with oil, and the eating of such food is generally considered to be unhealthy. Conventional frying of foods also leaves deposits on the pan which can be difficult to remove by washing, as well as producing an oil vapour which can produce an unpleasant environment and produce oily deposits on surrounding surfaces. Furthermore, although steaming of food is generally considered to be a healthier way of cooking, in that it removes less of the nutritional value of the food than boiling for example, boiling is more often used as it requires less skill and supervision.

Whilst cooking of food is conventionally undertaken by direct application of heat to the area containing the food, it is known to warm food by passing a flow of heated air through a chamber containing the food. GB 1223799 discloses such a warming arrangement in which food in a first chamber is heated by heated air which is circulated by a fan in a second chamber, the air being heated by heating elements within the first chamber. In this case the air is heated in the chamber which contains the food, and this will tend to mean that the food is heated unevenly and will certainly limit the processes which can be applied to the food during heating.

It is an object of the invention to provide a novel appliance which is capable of being used for cooking or warming and/or washing or cleaning in a

kitchen environment, and which is in addition usable in other applications, such as cleaning of fabrics and other articles.

The invention is defined in its various aspects in the accompanying claims.

In one embodiment of the invention the appliance is adapted for cooking or warming of food in a kitchen environment, either in the home or in commercial premises. In this case the appliance may be provided with a variety of interchangeable food holders and various arrangements for introducing oil, steam or water during the cooking process, so that the appliance can be used for baking, steaming, grilling, frying or rossitering of many different types of food. Such a cooking appliance may also be adapted to perform a cleaning cycle so that the parts of the appliance which become contaminated during cooking, and possibly even crockery and other articles used for serving and eating of the food, can be cleaned during the cleaning cycle.

In another embodiment the appliance is adapted for washing or cleaning of articles, such as fabrics or crockery, so as to perform the function of a washing machine or dishwasher. In this case the appliance may be adapted to perform various washing or cleaning operations, either individually or in sequence, such as the application of steam or water and detergent to the articles, the application of rinsing water and the drying of articles by heated air. It is even possible for a cooking appliance in accordance with the invention to be adapted to wash fabrics when used in a washing mode.

In another embodiment the appliance is adapted for cleaning or sterilizing of articles in a hospital or laboratory environment or in an industrial process. In this case the appliance will be adapted to perform the required sequences of cleaning operations using steam and/or water, rinsing and drying, where appropriate.

Certain appliances in accordance with the invention are particularly advantageous as they render the use of cooking pans unnecessary. They can also enable a wide range of cooking processes to be applied to the food and can permit control manually or by a preset programme. Food may thereby be cooked in a way which ensures good taste and high nutritional value, and which minimises unhealthy cooking residues. Since a single appliance may be used for carrying out a number of different cooking processes, and even for subsequent cleaning and washing, a single such appliance may perform the functions of a number of conventional appliances, and an overall saving in costs is obtained. The ability to carry out a number of different cooking processes under automatic control may be particularly important in commercial operations, and enable a greater variety of foods to be offered over longer periods of time.

In order that the invention may be more fully understood, preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic section through a kitchen appliance in accordance with the invention;

Figure 2 is a schematic representation showing the flow paths within the appliance of Figure 1;

Figures 3 to 11 are schematic representations of various cooking attachments for use in the appliance of Figure 1;

Figure 12 is a schematic representation of an attachment for use in washing of crockery within the appliance of Figure 1;

Figures 13 to 15 are explanatory diagrams indicating the construction of the drum in the appliance of Figure 1;

Figures 16 to 19 are block diagrams illustrating possible cooking, cleaning and washing cycles which may be used in the control of the appliance of Figure 1;

Figure 20 is a front view of the appliance of Figure 1 showing a control panel; and

Figures 21 and 22 are explanatory diagrams showing the movement of food within a food container during rotation of the drum.

Figure 1 shows an appliance which may be used in a kitchen environment for cooking food, either by baking, steaming, grilling, frying or rossitering or some other process, for subsequently cleaning the contaminated parts of the appliance after

cooking, for washing crockery and other articles used in serving and eating of the cooked food, and even for the cleaning and washing of fabrics in a separate operation. However it should be understood that, although an appliance which is capable of performing all these operations is described with reference to Figure 1, other forms of appliance in accordance with the invention are adapted for performing only one or some of these functions, and in such appliances a number of parts included in the appliance of Figure 1 or described with reference to the other figures can be omitted since they will not be required for the function or functions which the particular appliance is required to perform.

Referring to Figure 1, the appliance 1 has a casing 2 incorporating first and second chambers 3 and 4 interconnected by an inlet 5 which may be closed off by a flap 6. The first chamber 3 contains a heat source in the form of an electrical heater 7 consisting of a series of heating wires spaced apart within the chamber 3. Alternatively the heat source may consist of oil or gas burners. The second chamber 4 contains an impeller in the form of a rotary drum 8 which is rotatable about a horizontal axis and has an apertured cylindrical outer wall 9, open ends 10 and outwardly extending vanes 11.

Furthermore a drive unit in the form of a reversible, variable speed electric motor 12 is located in the first chamber 3 and serves to rotate the drum 8 by means of a belt 13 which extends over a drive pulley 14 on the motor output shaft and a driven pulley 15 on a rotatable shaft 16 fixed to the drum 8 and surrounding a fixed centre shaft 17. The motor speed and direction, and hence the speed and direction

of rotation of the drum 8, can be controlled by a pre-selected programme. As shown diagrammatically in Figure 2, and as will be described in more detail below with reference to Figures 14 and 15, rotation of the drum 8 by the motor 12 causes heated air to be drawn from the first chamber 3 into the second chamber 4 by way of the inlet 5, and directs heated air through the apertured outer wall 9 of the drum 8 and into the inner space 18 within the drum 8, as shown by the arrows in Figure 2. Food contained within the inner space 18 is thereby cooked or heated by the heated air passing into the inner space 18.

Various arrangements are provided for supply of fluids to the inner space within the drum 8 for use in cooking and/or subsequent cleaning or washing, and these will now be described with reference to Figure 1. Firstly an oil tank 20 is provided for containing cooking oil which is pressurised by means of gas or spring pressure and which is capable of being supplied to an oil injection nozzle 21 extending through the rear wall of the chamber 4 by way of a solenoid valve 22 and a duct 23. A fine oil mist may be injected into the inner space within the drum 8 by the oil injection nozzle 21 when the solenoid valve 22 is opened on receipt of a suitable actuating signal. In this way the inner space within the drum 8 becomes heavy with oil vapour and food may be fried without it becoming saturated with oil.

In addition a steam boiler 24 is provided for injecting steam into the inner space within the drum 8 by way of a solenoid valve 25, a duct 26 and a steam jet nozzle 27 extending through the rear wall of the chamber 4. The supply of steam to the inner space through the steam jet nozzle 27 is controlled by an actuating signal

supplied to the solenoid valve 25. Furthermore water is supplied to the steam boiler 24 by way of a pipe 28, a water filter 29 and a connecting pipe 30. The filter 29 serves to filter out any unwanted contaminates, such as bacteria or minerals, which may contaminate the food or be harmful to the steam boiler 24. Automatic monitoring of the steam density or moisture within the inner space is performed by a sensor 31, and the solenoid valve 25 may be controlled in dependence on the result of such monitoring in order to maintain the steam conditions within the inner space at required levels. The steam may be supplied either for the purpose of steaming food or as part of a cleaning or washing cycle, as will be described in more detail below. The steam boiler 24 incorporates its own heating element and sensing arrangement which is used to limit the production of steam for safety purposes.

Cold water for cleaning or washing can be supplied to the chamber 4 through a cold water spray inlet 33 extending through the rear wall of the chamber 4 by way of a solenoid valve 34 and a duct 35. Furthermore hot water for cleaning or washing can be supplied to the chamber 4 through a hot water spray inlet 36 extending through the rear wall of the chamber 4 by way of a solenoid valve 37 and a duct 38. In addition detergent from a detergent bottle 39 can be introduced along a duct 40 to a venturi 41 which is also supplied with cold water by way of a solenoid valve 42 and a duct 43 in order to draw detergent from the bottle 39 into the chamber 4 by venturi action. The supply of detergent to the chamber 4 is controlled by an actuating signal supplied to the solenoid valve 42. Furthermore the cold water system additionally includes a solenoid valve 44 for controlling supply of water to the pipe 28 connected to the water filter 29, and an inlet connector union 45 by way of which

cold water is supplied to each of the solenoid valves 34, 42 and 44 from an external cold water source. The hot water system further includes an inlet connector union 46 by way of which hot water is supplied to the solenoid valve 37 from an external hot water source.

Other sensing arrangements which extend through the rear wall of the chamber 4 are an air temperature sensor 48 which may be used to control the heater 3, a water temperature sensor 49 which can be used to monitor the heat of the water in the chamber 4 during washing or cleaning to control a water heater 50 in the outer wall of the chamber 4, and a water level detector 51 which can be used to control the level of water in the chamber 4 during washing or cleaning. The water heater 50 will not generally be used if a hot water supply to the inlet connector union 46 is available. Furthermore an over-pressure relief valve 52 is provided at the top of the chamber 4 in order to allow for pressure relief in the event of over pressure within the chamber 4 during cooking.

A drain-off chamber 53 is provided at the bottom of the chamber 4 below the drum 8 through which fluids may drain off during cooking, so as to prevent accumulation of unwanted fluid at the bottom of the chamber 4 which may become heated and lead to air contamination. The drain-off chamber 53 is provided with a grill 54 to prevent larger solids entering the chamber 53, and a drain-off solenoid valve 55 which can be opened on receipt of an appropriate actuating signal during the cleaning or washing cycle to draw off waste water from the chamber 4. The solenoid valve 55 is normally closed during cooking, and is only opened to discharge waste

water during cleaning or washing.

The first chamber 3 containing the heater 7 is provided with an anti-depression flap 56 which permits air to enter the chamber 3 from outside but prevents output of heated air from the chamber 3 to the outside. If the pressure within the chambers 3 and 4 drops below atmospheric pressure during cooking, the flap 56 is caused to open to admit air. Furthermore a solenoid actuator 57 is provided for opening the flap 6 closing off the inlet 5 when the heater 3 is switched on. When the heater 7 is not switched on, the flap 6 closes off the inlet 5 to prevent the back flow of fluids from the second chamber 4 to the first chamber 3 which would contaminate the chamber 3 and lead to the production of smoke or high humidity during subsequent heating. The flap 6 is provided with a balance orifice 58 at its centre so as to balance the pressures in the first and second chambers 3 and 4. In the absence of such pressure balance the flap 6 would tend to be opened or closed by the pressure difference regardless of the position of the solenoid actuator 57. A flow-back drip point 59 is provided at the top of the chamber 4 adjacent the flap 6 so as to prevent fluid flowing back towards the flap 6.

Various cooking attachments can be fitted into the inner space within the drum 8 for cooking food within the appliance, and these will now be described with reference to Figures 3 to 11. Four quadrants are available around the inside of the outer wall 9 of the drum 8 for receiving food holders, and Figure 3 shows a food holder in the form of a basket 60 which may be fitted into a suitably shaped recess in one of the quadrants of the drum wall 9, as shown in the upper part of the figure,

so that heated air passing through the apertures in the drum wall 9 flows through the basket 60 to effect cooking or heating of the food within the basket 60. When the food is to be removed after cooking or heating, the basket 60 can simply be removed from the recess as shown at 16' in the figure, and a lid 61 opened as shown as 61', to allow the food to be removed. The detachable basket 60 can subsequently be replaced in the recess for cleaning within the appliance in a subsequent cleaning cycle.

Figure 4 shows a food holder in the form of a dish 62 provided with a grill 63 and a tension plate 64 between which non-uniformly sized flat pieces of food, such as steaks, may be held. The grill 63 is provided with flexible projections 65 against which the tension plate 64 bears when fitted to the dish 62 by clips (not shown), and which are adjustable to accommodate food of various thicknesses. The grill 63, which is circular as shown at the bottom of the figure, helps to apply an even tension across the food. Although not specifically shown in Figure 4, it will be appreciated that the dish 62 is of similar curved shape to the basket 60 of Figure 3 to enable it to fit within a recess in the drum wall 9 in a similar manner to the basket 60.

Figure 5 shows an attachment 66 for fitting within a basket 60 to hold food, such as potatoes or large vegetables, within the basket 60 for baking or steaming. The attachment 66 incorporates large apertures 67 and small apertures 68 for holding large and small items of food, and is of an appropriate curved shape to fit within the basket 60.

Figure 6 shows an attachment 69 which is also of appropriate curved shape to fit within the basket 60 and which is provided for holding pre-packed food or large pieces of food within the basket 60. Figure 7 shows an attachment 70 which is used in a similar manner to the attachment 69 but for holding smaller items of food, such as peas, within the basket 60. Figure 8 shows a further attachment 71 which is again used within the basket 60, this time for holding medium-sized items of food, such as sausages or brussel sprouts, in position within the basket 60. Each of the attachments 69, 70 and 71 is in the form of a shaped spring steel wire which is capable of holding the food in the basket 60 in position when placed under tension within the basket so as to prevent the food being damaged by being tumbled or squashed within the basket 60 during rotation of the drum 8.

Figure 9 shows on the left hand side a rotisserie attachment 72 having pins 73 which are receivable within locating holes in the fixed shaft 17 so that the attachment 72 extends axially within the drum 8 but is held stationary during rotation of the drum 8. The attachment has prongs 74 which may be used for holding large items of food, such as poultry or joints of meat, which cannot fit within a basket 60. The opposite end of the attachment 72 is supported by a crossbar 75 extending diametrically across the end of the drum 8, and supported so as to maintain the attachment 72 stationary during rotation of the drum 8. Alternatively, as shown in a detailed view 76, the crossbar 75 may be locked with respect to the drum 8 by a lock-pin 77 so as to permit the attachment 72 to be rotated with the drum 8, such rotation being permitted by a pivot bearing 78. Figure 9 also shows another attachment 80 which may be used in a similar way to the attachment 72 but which

must be maintained stationary during rotation of the drum so as to support food, such as bread or pre-cooked foods to be reheated on one or more shelves 81. The attachment 80 may have one or more shelves in the form of a grill or a solid tray. Figure 9 also shows a further attachment 82 in the form of a large basket which may be used in place of the attachment 72 or the attachment 80, but which is adapted to be rotated with the drum 8 for foods which need to be heated and tumbled at greater speeds than normal.

Figure 10 shows an attachment 83 which may be fitted into one of the recesses in the drum wall 9 in a similar manner to the basket 60, but which is in the form of a container having a removable lid 84 for containing liquid food or food to be held within a liquid for cooking. The attachment 83 can be used for casseroles or stews or for containing foods in such a manner that they do not become contaminated by oil which is being used for cooking of food outside the container. The lid 84 is snapped or screwed into position to prevent it being displaced during drum rotation, and has a breather hole 85 at its centre to allow for expansion of air within the container. If desired, the attachment 83 may be provided with separate receptacles within the container so that two different foods can be cooked within the container at the same time.

It will be apparent that different foods can be cooked within the appliance at the same time using different attachments and possibly even different cooking processes, and Figure 11 diagrammatically shows the manner in which up to four food holders 86 can be held within recesses provided in different quadrants of the

drum wall 9 so as to rotate with the drum, while at the same time a static shelf assembly 87 can be used to support food for cooking without revolving.

A considerable range of cooking processes can be undertaken by the use of appropriate attachments and appropriate control of the appliance. Thus baking or grilling can be carried out either with the food static or rotating or tumbling, and variations can be applied by varying the speed of drum rotation so as to vary the air flow or by varying the level of heating of the air by the heater 7, or even by increasing the moisture content by the application of steam through the steam jet nozzle 27. Steaming can be used in all areas of cooking, and is particularly advantageous in that it retains a greater portion of the nutritional value of the food. Frying of food can also be carried out either with the food static or rotating or tumbling by the provision of an oil mist injected through the oil injection nozzle 21. In this way deep oil frying of food is rendered unnecessary, and fried food is obtained which is free from excess oils and fats. Furthermore the food can be rotated at high speed at the end of the cooking process so as to throw off unwanted oils.

In any of these cooking processes different effects can be achieved by use of different attachments. If the food is maintained static during cooking, by being placed on a static shelf arrangement 87 as shown in Figure 11 for example, the heat will tend to be circulated all round the food, whereas, if the food is constrained within a food holder attached to the inside of the drum during rotation, the heat will tend to be forced radially through the food, that is in one direction relative to the food which will be held in a constant position relative to the drum wall during rotation.

Alternatively, if the food is held within an attachment, such as the attachment 83 shown in Figure 10,which rotates with the drum but allows the food to turn within the container during such rotation, constant turning of the food can be achieved during cooking.

There are also a number of variations which can be used during rossitering of food using an attachment such as the attachment 72 shown in Figure 9. In a constant dip baste process, the food may be turned during cooking so that it continually picks up sauce from a static tray placed beneath the attachment. In a drip baste process liquid within a container, or a solid block which becomes liquid when heated, may be attached to the inside of the drum wall so that it rotates with the drum and so that, at its highest point during such rotation, liquid is caused to drip from the container or block onto the food which is being rossitered. In a natural baste process the food's own natural juices run over it as it is turned during cooking. Finally, in a static baste process, the food is not turned so that food is permitted to drain through the base of the food during cooking.

During reheating of food it is important that the food does not become dried out by being overheated or become soggy due to high moisture content. The use of steam during such reheating can be particularly advantageous as it prevents the food from drying out and serves to retain the taste of the food by virtue of the fact that it provides a moisture laden atmosphere. Steaming may be controlled either automatically according to a preset programme or manually by depression of a push button. In either case, however, the steam may be regulated in dependence on the

steam monitoring performed by the sensor 31.

In all cooking processes the temperature is monitored by means of the sensor 48, which is a conventional thermocouple sensor, and where necessary the heater 7 is adjusted so as to provide the required level of heating as determined by a preset programme or by manual operation.

After cooking has been completed cleaning of the various attachments and of the cooking area within the appliance generally can be carried out in a separate cleaning cycle with the attachments fitted within the drum 8. Either at the same time or subsequently crockery or other articles used for serving and eating of the food can be cleaned by placing them within the drum 8 utilising a detachable crockery holder 90, as shown in Figure 12. The cleaning cycle may include a number of steps which will be described in more detail below.

Figure 13 shows a drum attachment 91 which may be slotted into the drum 8 for containing fabrics during steam cleaning or washing. The drum 91 is perforated to permit fluids to pass into and out of the space within the drum 91 during a cleaning or washing process.

Figures 14 and 15 show diagrammatically the outer wall 9 of the drum 8, and the vanes 11 extending outwardly from the drum wall 9. At the base of each vane 11 is a slot 92 which provides for passage of heated air through the drum wall 9 into the inner space within the drum. As the drum 8 is rotated in the direction of

the arrow 93, as shown in Figure 15, heated air is forced through the slots 92 in the direction of the arrows 94. As may be appreciated more particularly from the diagram 95 shown in Figure 14, the anglular orientation of the vanes 11 means that the flow of air is throttled as it passes through the slot 92, thus resulting in increased air flow through the slot 92. The resulting air flows passing through the drum wall 9 give rise to turbulent circular air flows around the inside of the drum and thus provide a constant supply of heat to food located at the centre of the drum, as well as supplying heat to the inside of food holders attached to the inside surface of the drum. Of course the air flows through the slots 92 also pass through the food holders attached to the inside surface of the drum so as to provide heat flow from the outer part to the inner part of each food holder. The circulation of heated air provided in this manner is such as to ensure that the heat is evenly distributed around the chamber 4 and is not concentrated locally. During the cleaning cycle the vanes 11 serve to pick up water and/or cleaning fluid from the bottom of the chamber 4 during rotation of the drum 8, and to cause such water or cleaning fluid to pass through the slots 92 into the inner space within the drum 8. This produces fluid turbulence within the drum 8 which can assist in loosening of contaminates from the parts to be cleaned, or, in the case of washing of fabrics, provide a generally improved washing action. Rotation of the drum 8 in the opposite direction can be used to expel fluid from the inner space. As already mentioned above high speed rotation of the drum 8 can be used to expel cooking juices or oils during cooking.

Figures 16, 17, 18 and 19 show various cycles which may be undertaken under the control of appropriate control programmes provided within the appliance

control unit. It should be understood that, in practice, the control unit will incorporate a very large number of programmes which can be initiated by suitable actuation at the beginning of the process, and that the particular cycles illustrated diagrammatically in these figures are given only by way of example.

Figure 16 illustrates an automated washing cycle which is initiated after placing of the washing load, such as clothes, within the inner space of the appliance, and subsequent closing of the door. As will be easily understood from referring to the diagram, the washing cycle, which optionally includes an initial steam cycle, involves filling of the inner space with water supplied by way of the cold water system and, if available, the hot water system, the water level being monitored by the detector 51, the water temperature being monitored by the sensor 49, and heating being applied by the heater 50 if appropriate. Drum rotation is effected by the motor 23, and subsequent draining is carried out by actuation of the drain-off solenoid valve 55. After rinsing and spinning to remove excess water, air drying of the washing load may be effected by the supply of heated air during rotation of the drum 8, and this is optionally followed by a further steam cycle.

Figure 17 illustrates an automated cleaning cycle such as might be used for cleaning of the cooking area and ancillary attachments and/or cleaning of crockery. In this case the particular sequence of operations performed is different to the sequence of operations characterising the washing cycle of Figure 16, although generally similar types of operation are used in the two processes.

Figure 18 illustrates an automated cooking cycle for use in the frying of food. After selecting of the food and placing it in an appropriate food holder, the holder containing the food is placed in the cooking area within the appliance and the door is closed. If necessary the cooking area is pre-heated by operation of a start cycle before the food is placed in the appliance. During actual cooking heated air is applied to the cooking area during rotation of the drum 8, and an oil mist is provided within the cooking area by the oil injection nozzle 21, under control of an appropriate programme. At all stages the temperature is sensed by the sensor 48 and the moisture is sensed by the sensor 31, and appropriate control is exerted over the speed of rotation of the drum 8 and the injection of oil to provide optimum cooking conditions. At the end of the cooking cycle the drum 8 is rotated at high speed in order to expel excess oil from the food.

Figure 19 illustrates a general cooking cycle which may include injection of steam by way of the steam jet nozzle 27, and again involves monitoring of temperature, moisture level, speed of rotation of the drum and time elapsed so as to provide optimum cooking conditions.

Figure 20 is a front view of the appliance 1 showing the door 96 by way of which articles are placed in, and removed from, the inner space within the drum, and a control panel 97 providing various controls for manual operation of the appliance or setting of an appropriate control programme, as well as a display for displaying the various parameters set.

Figures 21 and 22 illustrate the manner in which different speeds of rotation of the drum 8 and different shaped food containers 98 and 99 attached to the inside surface of the drum 8 can affect cooking. The small container 98 will present a smaller surface area to heated air passing through the drum wall 9 than will the larger container 99, as shown by the arrows in Figure 21, so that food within the smaller container 98 will be heated at a slower rate than food within the larger container 99. Furthermore, when the drum 8 is rotated at low speed, as shown in the upper part of Figure 22, the food within the larger container 99 will be tumbled twice during a single revolution of the drum, whereas the food within the smaller container 98 will only be turned through one revolution. During high speed rotation, as shown in the bottom part of Figure 22, on the other hand the food will be thrown out towards the radially outer part of the container 98 or 99 in each case, and this will provide a greater surface area for the transmission of heat conducted from the heated air passing through the drum wall 9. Thus the food will tend to be heated at a greater rate when the drum is rotated at high speed. If required it is possible for the cooking programme to include periods in which rotation of the drum 8 is stalled in order to throw the food within the container 98 or 99.

CLAIMS

1. A kitchen appliance comprising a casing incorporating first and second chambers which are communicable by an air inlet, a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet, a rotary impeller in the second chamber, and a drive unit for rotating the impeller to draw heated air from the first chamber into the second chamber through the air inlet,

characterised in that the impeller is in the form of a drum having an apertured outer wall surrounding an inner space for containing the object to be treated such that rotation of the drum by the drive unit causes heated air from the air inlet to be drawn through the apertured outer wall and into the inner space within the drum.

2. An appliance according to claim 1, wherein the drum incorporates outwardly extending vanes spaced about the periphery of the outer wall, the apertures in the outer wall being positioned between the vanes.

3. An appliance according to claim 1 or 2, wherein the drive is arranged to be rotated by the drive unit about a horizontal axis.

4. An appliance according to claim 1, 2 or 3, wherein a door is provided for gaining access to the inner space within the drum.

5. An appliance according to any preceding claim, wherein at least one nozzle

is provided for injecting a fluid into the inner space within the drum.

6. An appliance according to any preceding claim, wherein a boiler is provided for producing steam to be injected into the inner space within the drum.

7. An appliance according to any preceding claim, wherein a control unit is provided for controlling the speed or direction of drum rotation or the degree of heating of the air or the injection of fluid or steam according to the treatment required.

8. A cooking or warming appliance comprising a casing incorporating first and second chambers which are communicable by an air inlet, a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet, a rotary impeller in the second chamber, and a drive unit for rotating the impeller to draw heated air from the first chamber into the second chamber through the air inlet,

characterised in that the impeller is in the form of a drum having an apertured outer wall surrounding an inner space for containing the food to be cooked or warmed such that rotation of the drum by the drive unit causes heated air from the air inlet to be drawn through the apertured outer wall and into the inner space within the drum.

9. An appliance according to claim 8, wherein a nozzle is provided for injecting oil into the inner space within the drum for frying of food within the inner space.

10. An appliance according to claim 8 or 9, wherein a nozzle is provided for injecting steam into the inner space within the drum for steaming of food within the inner space.

11. An appliance according to claim 8, 9 or 10, which includes at least one food holder receivable within the inner space within the drum so as to be rotatable with the drum when rotated by the drive unit.

12. An appliance according to claim 11, wherein the food holder is perforated so as to permit passage of heated air through the holder.

13. An appliance according to claim 11 or 12, wherein the food holder is a container having a removable lid for containing liquid or semi-liquid food or liquid containing food.

14. An appliance according to claim 11, 12 or 13, wherein the food holder is attachable to the inside of the outer wall of the drum.

15. An appliance according to any one of claims 11 to 14, wherein the food holder incorporates at least one separator for dividing the food holder into compartments for containing different foods.

16. An appliance according to any one of claims 8 to 15, which includes at least one food holder fixedly receivable within the inner space within the drum so as

to remain stationary when the drum is rotated by the drive unit.

17. An appliance according to any one of claims 8 to 16, which includes a food holder in the form of a rotisserie for turning of food within the inner space within the drum.

18. An appliance according to any one of claims 11 to 17, wherein the or each food holder is detachable so as to be removable from the inner space and replaceable by another food holder if required.

19. An appliance according to any one of claims 8 to 18, wherein at least one water inlet is provided for introduction of water into the second chamber during a cleaning cycle.

20. An appliance according to any one of claims 8 to 19, wherein a cleaning fluid inlet is provided for introduction of cleaning fluid into the second chamber during a cleaning or washing cycle.

21. An appliance according to any one of claims 8 to 20, which includes a detachable crockery holder which is receivable within the inner space within the drum during a cleaning or washing cycle.

22. An appliance according to any preceding claim, wherein a control unit is provided for controlling cooking according to a preset cooking cycle and for

controlling cleaning according to a preset cleaning cycle.

23. A washing or cleaning appliance comprising a casing incorporating first and second chambers which are communicable by an air inlet, a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet, a rotary impeller in the second chamber, and a drive unit for rotating the impeller to draw heated air from the first chamber into the second chamber through the air inlet,

characterised in that the impeller is in the form of a drum having an apertured outer wall surrounding an inner space for containing the article to be washed or cleaned such that rotation of the drum by the drive unit causes heated air from the air inlet to be drawn through the apertured outer wall and into the inner space within the drum.

24. An appliance according to claim 23, wherein a nozzle is provided for injecting steam into the inner space within the drum in a steam cleaning process.

25. An appliance according to claim 23 or 24, wherein at least one water inlet is provided for introduction of water into the second chamber in a washing or cleaning process.

26. An appliance according to claim 23, 24 or 25, wherein a cleaning fluid inlet is provided for introduction of cleaning fluid into the second chamber in a washing or cleaning process.

27. An appliance according to any one of claims 23 to 26, wherein a drain is provided for draining fluid from the second chamber after a washing or cleaning process.

28. An appliance according to any one of claims 23 to 27, wherein a control unit is provided for controlling washing or cleaning according to a preset washing or cleaning cycle followed by a preset drying cycle using heated air from the first chamber.

29. A kitchen appliance comprising a casing incorporating a first chamber, a heat source in the first chamber for producing a flow of heated air, an impeller, and a drive unit for driving the impeller to circulate the heated air,
characterised in that an inner space for containing the object to be treated is provided within a second chamber which is communicable with the first chamber by an air inlet such that rotation of the impeller by the drive unit causes heated air from the first chamber to be drawn through the air inlet into the second chamber to heat the object within the inner space.

30. A cooking appliance comprising a casing incorporating first and second chambers which are communicable by an air inlet, a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet, an impeller, and a drive unit for driving the impeller to draw heated air from the first chamber into the second chamber through the air inlet,
characterised in that an inner space is provided within the second chamber for

containing the food to be cooked, and a nozzle is provided for injecting oil into the inner space to permit cooking of the food in an oil environment.

31. A cooking or warming appliance comprising a casing incorporating first and second chambers which are communicable by air inlet, and a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet,

characterised in that a rotary drum is provided within the second chamber surrounding an inner space for containing the food to be cooked or warmed, and a drive unit is provided for rotating the drum, the drum having an outer wall having an inside surface which is adapted to receive at least one food holder such the food holder is rotated with the drum.

32. A cooking or warming appliance comprising a casing incorporating first and second chambers which are communicable by an air inlet, and a heat source in the first chamber for producing a flow of heated air to be passed into the second chamber through the air inlet,

characterised in that an inner space is provided within the second chamber for containing the food to be cooked or warmed by the flow of heated air, and a cleaning fluid inlet is provided for injecting cleaning fluid into the inner space to permit cleaning to be effected after cooking.

33. An attachment for a cooking or warming appliance having a rotary drum which is rotated during cooking or warming, the attachment comprising a food holder which is adapted to contain food and to be attachable to the inside of an outer wall of the drum within the appliance such that the food holder is rotated with the drum.

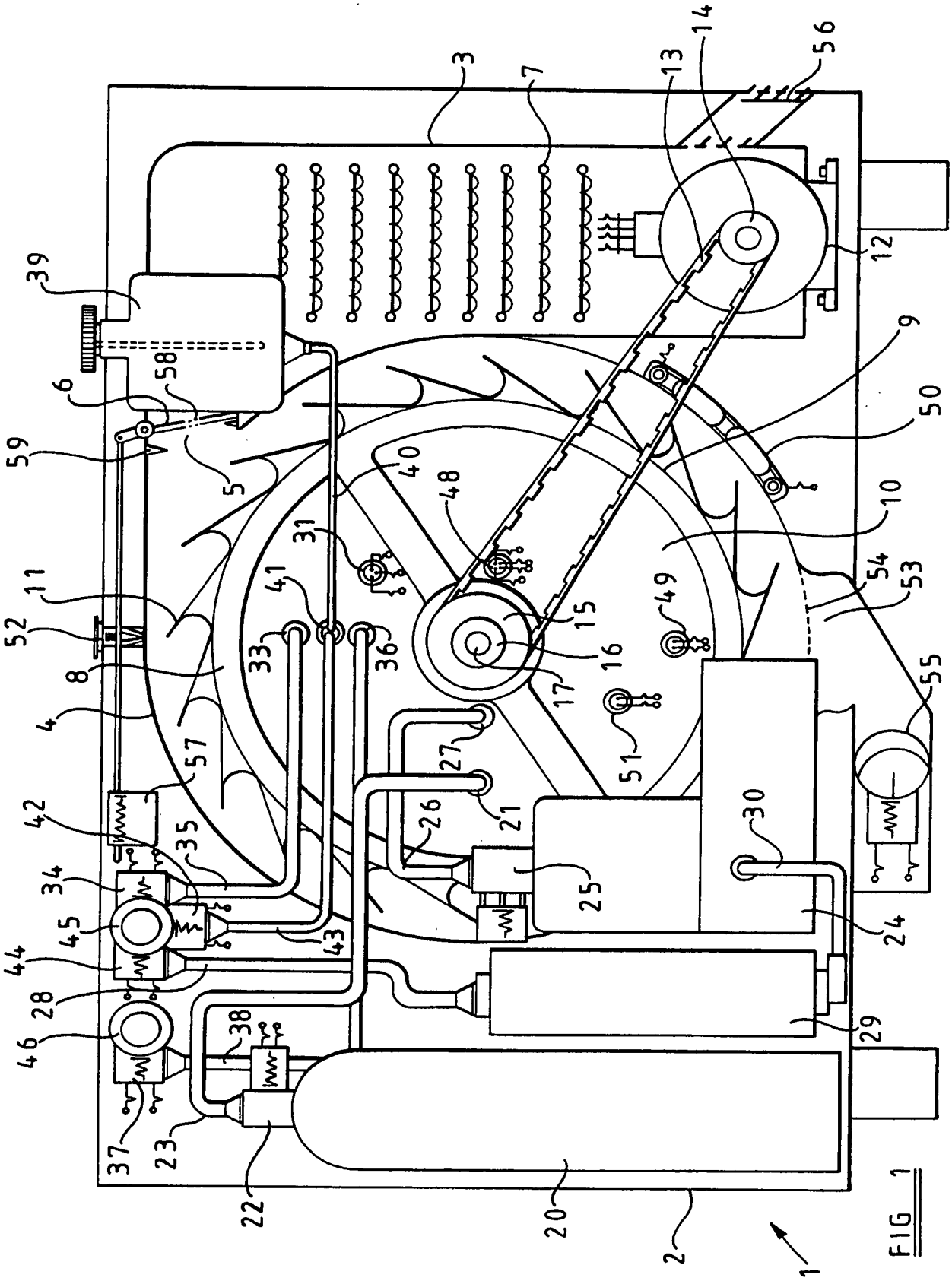
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FIG 1

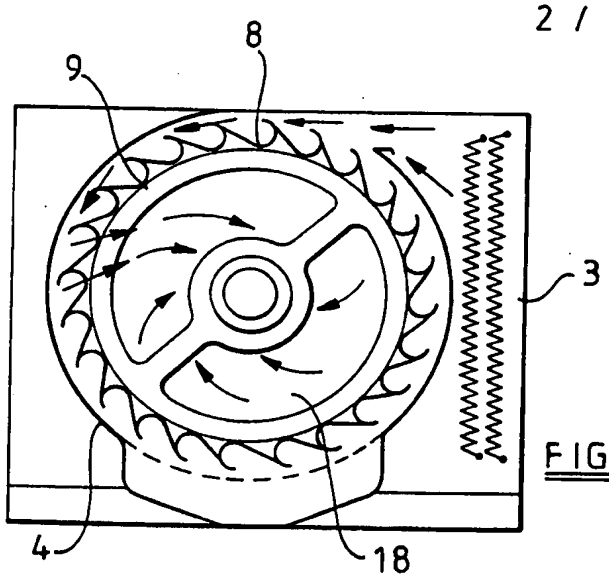


FIG 2

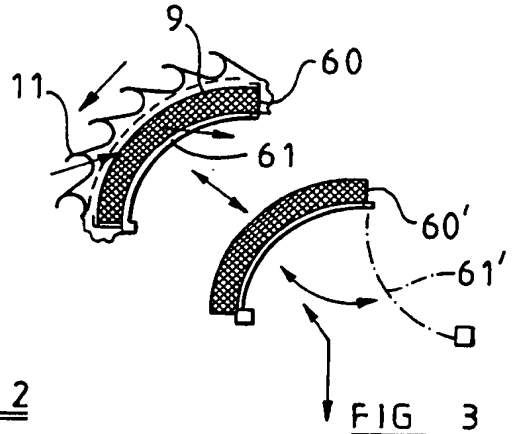


FIG 3

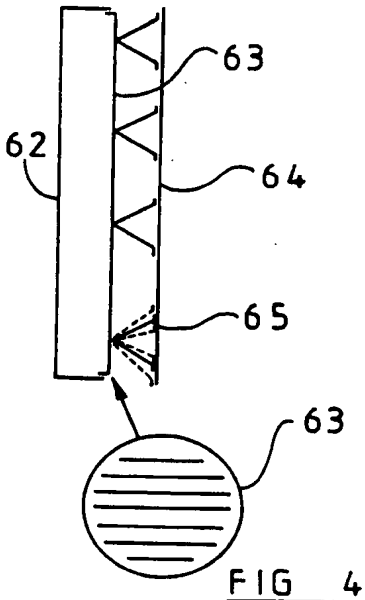


FIG 4

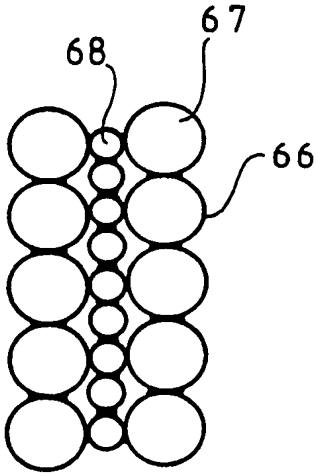


FIG 5

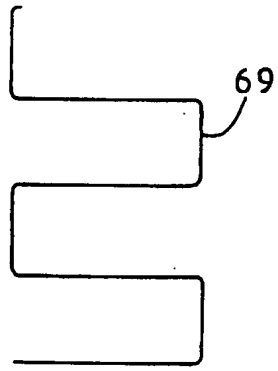


FIG 6

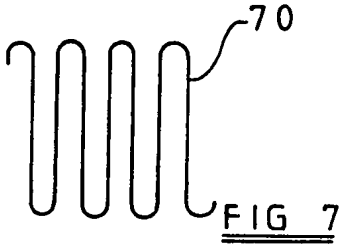


FIG 7

FIG 8

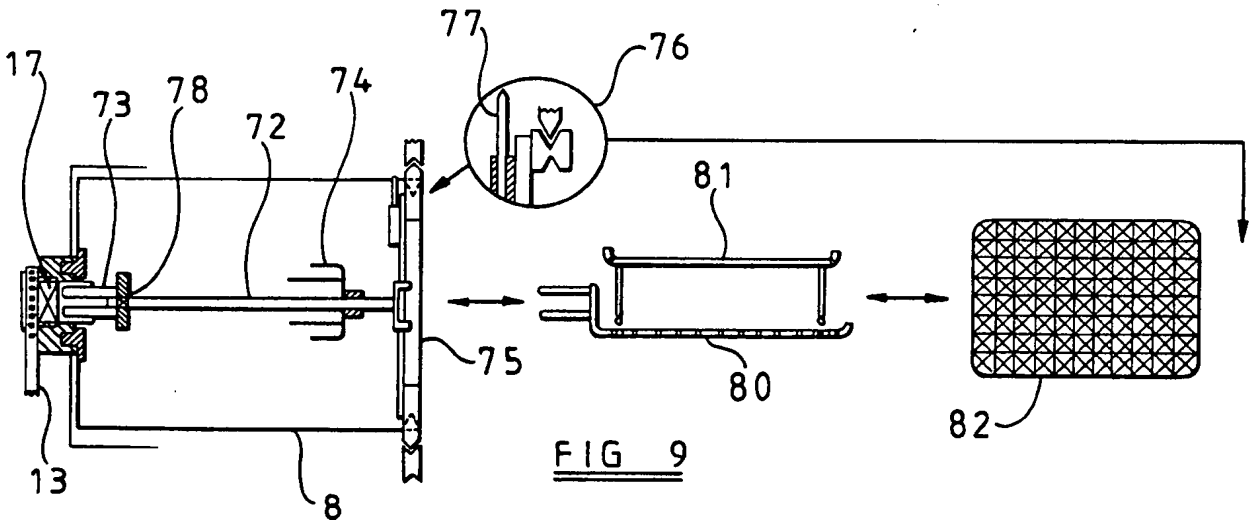
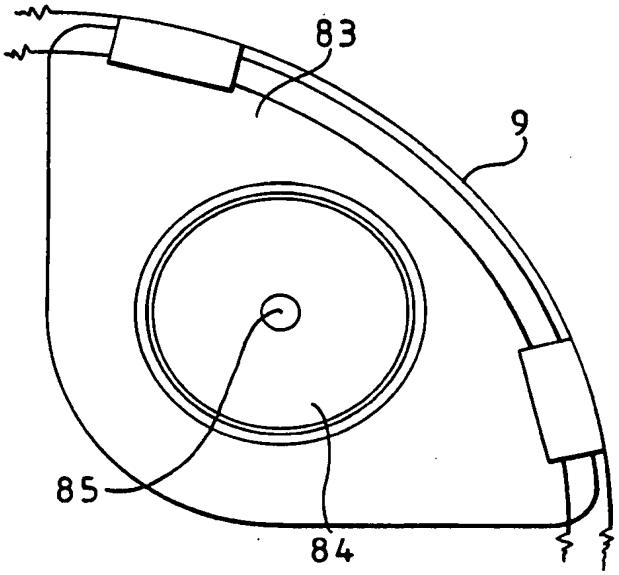


FIG 9

FIG 10



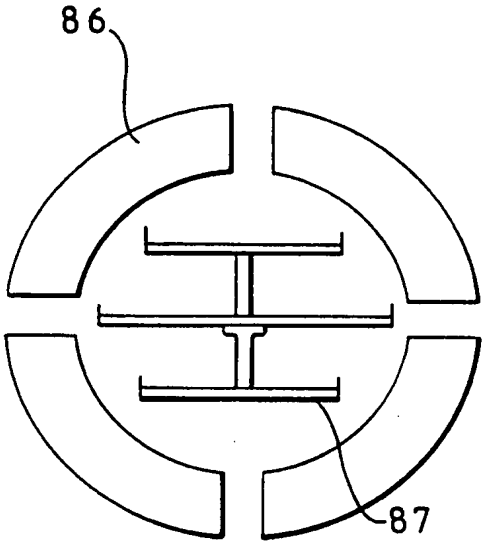


FIG 11

FIG 12

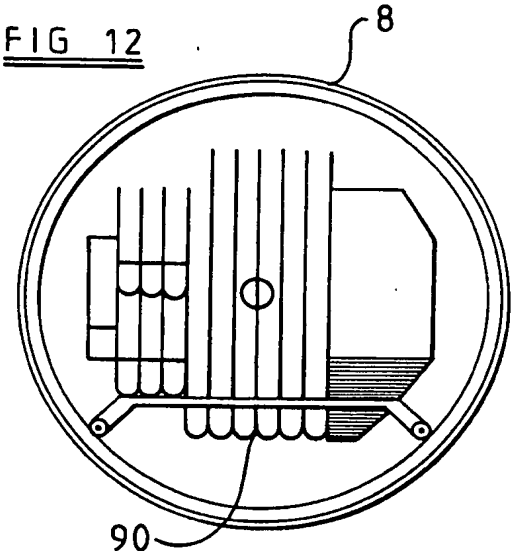
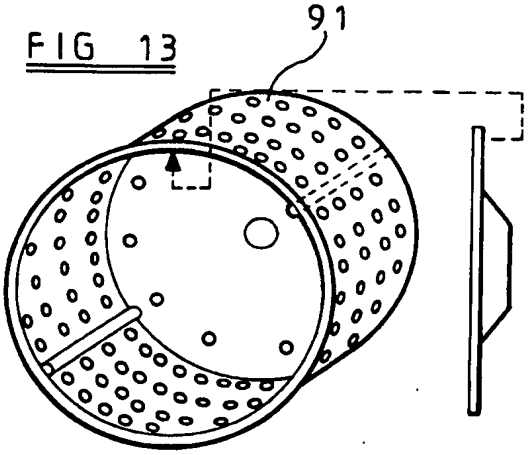


FIG 13



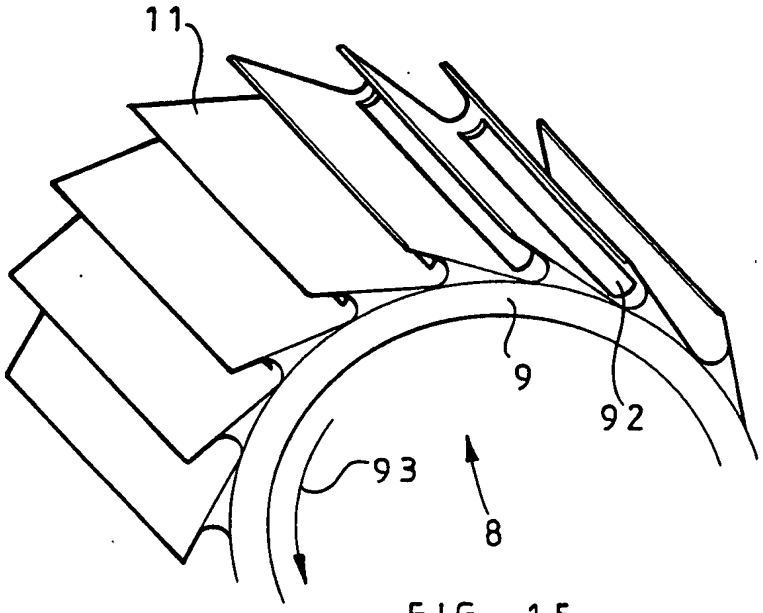


FIG 15

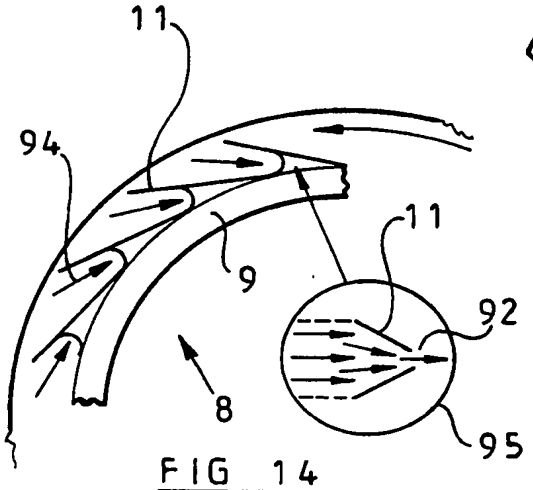


FIG 14

FIG 16

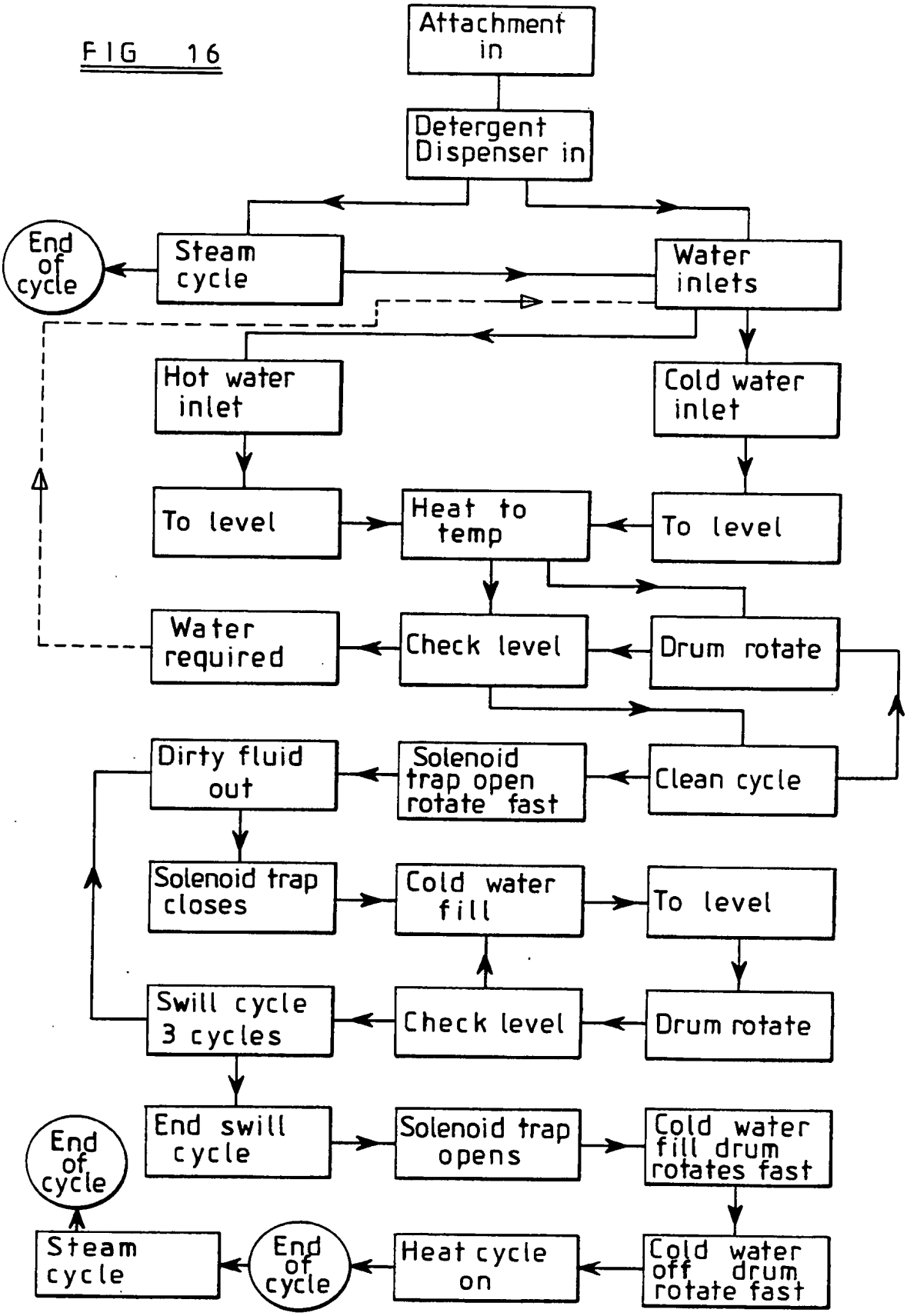

Attachment in
Detergent Dispenser in
End of cycle
Steam cycle
Water inlets
Hot water inlet
Cold water inlet
To level
Heat to temp
To level
Water required
Check level
Drum rotate
Dirty fluid out
Solenoid trap open rotate fast
Clean cycle
Solenoid trap closes
Cold water fill
To level
Swill cycle 3 cycles
Check level
Drum rotate
End swill cycle
Solenoid trap opens
Cold water fill drum rotates fast
End of cycle
Steam cycle
End of cycle
Heat cycle on
Cold water off drum rotate fast

FIG 17

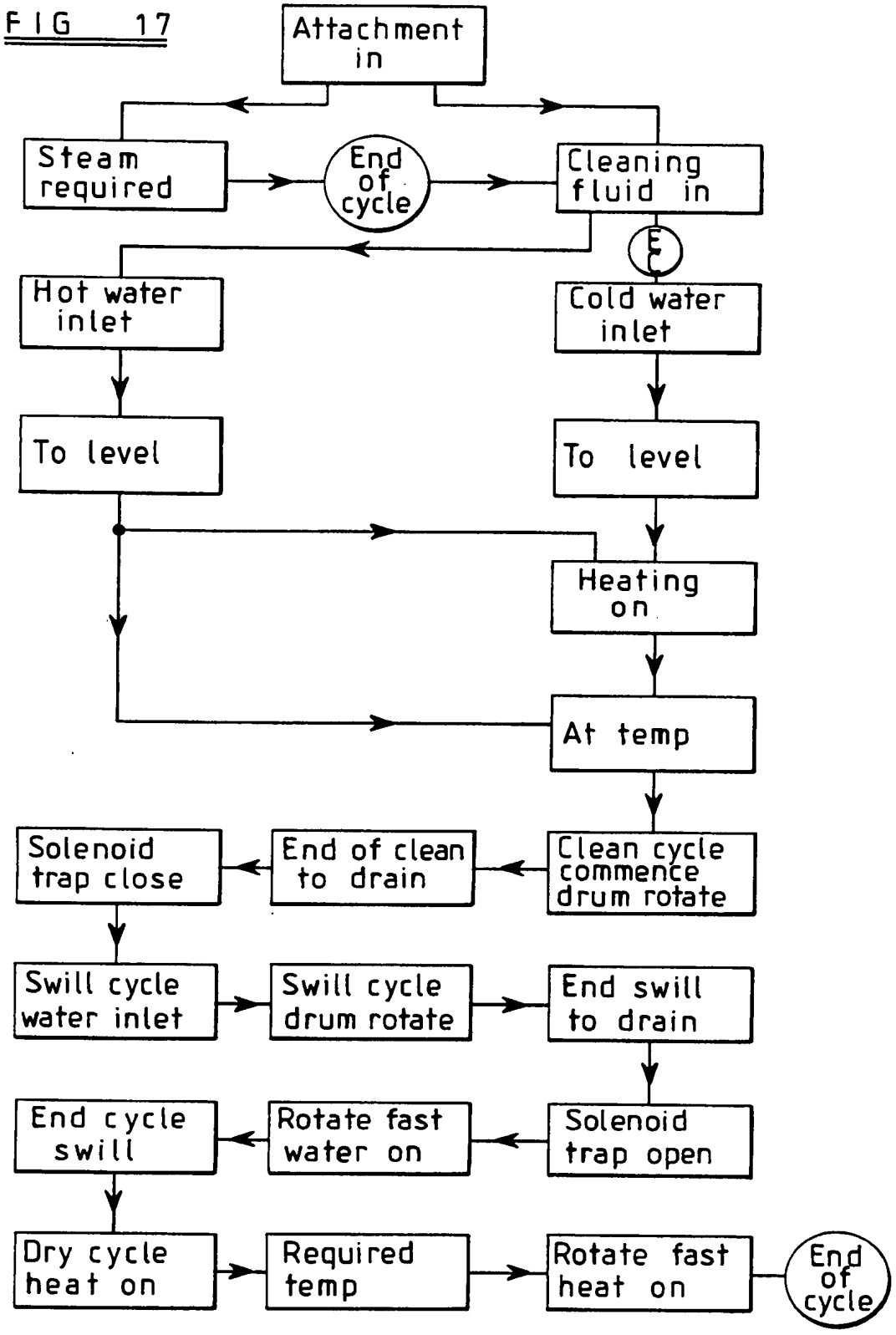

Attachment in
Steam required
End of cycle
Cleaning fluid in
E
Hot water inlet
Cold water inlet
To level
To level
Heating on
At temp
Solenoid trap close
End of clean to drain
Clean cycle commence drum rotate
Swill cycle water inlet
Swill cycle drum rotate
End swill to drain
End cycle swill
Rotate fast water on
Solenoid trap open
Dry cycle heat on
Required temp
Rotate fast heat on
End of cycle

FIG 18

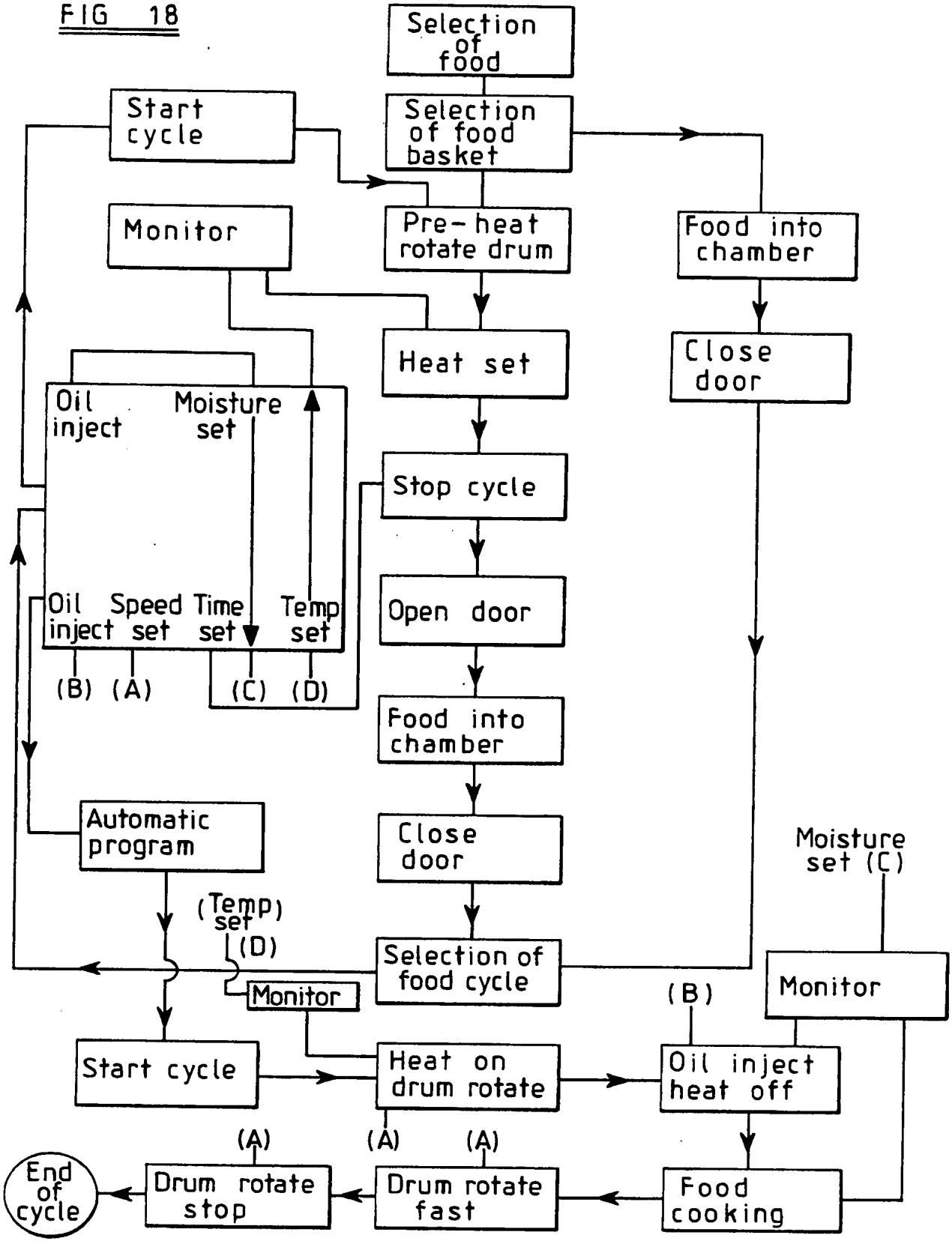
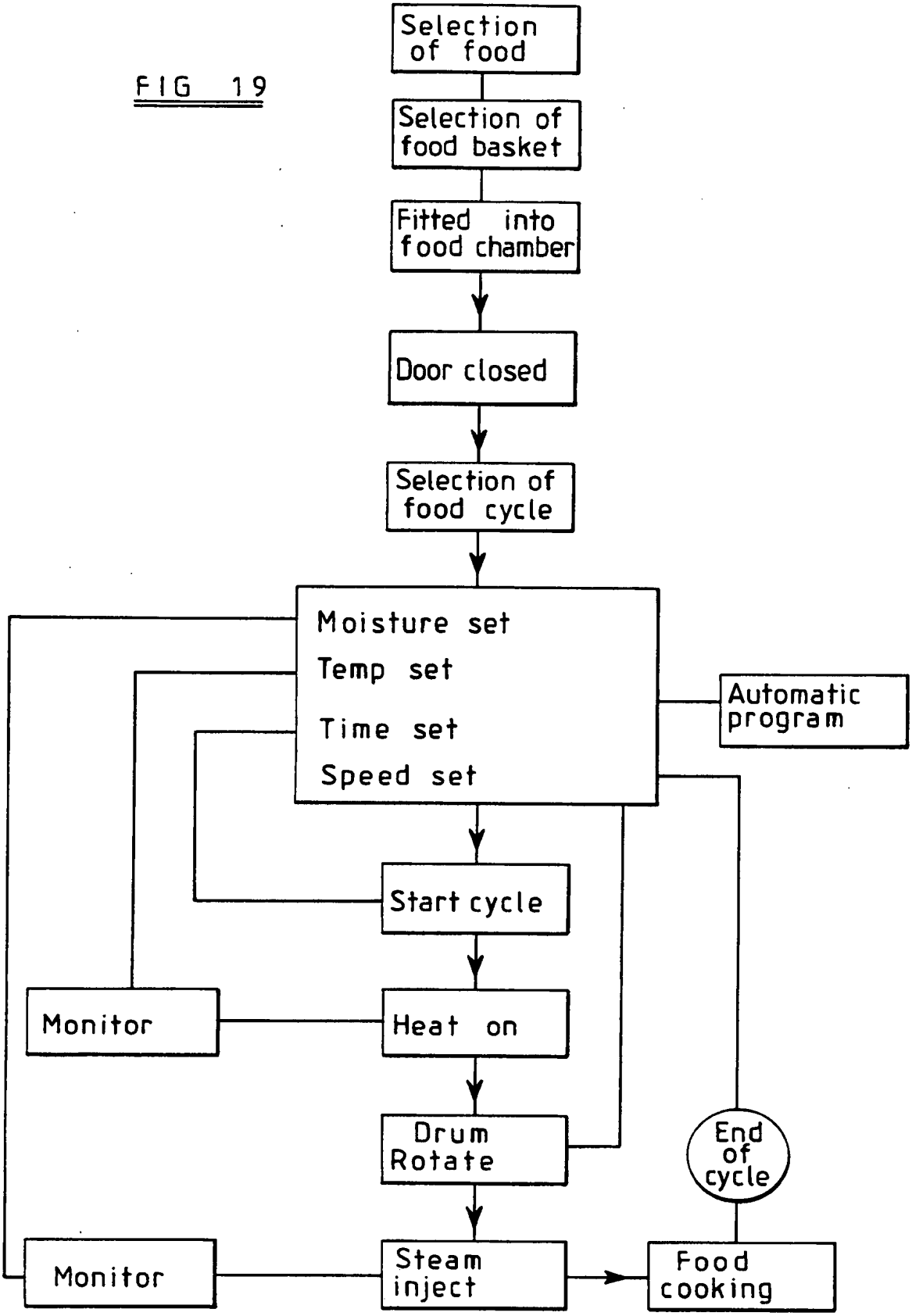

Selection of food
Start cycle
Selection of food basket
Monitor
Pre-heat rotate drum
Food into chamber
Heat set
Close door
Oil inject
Moisture set
Stop cycle
Oil inject
Speed set
Time set
Temp set
(B) (A) (C) (D)
Open door
Food into chamber
Automatic program
Close door
Moisture set (C)
(Temp) set (D)
Selection of food cycle
Monitor
(B)
Monitor
Start cycle
Heat on drum rotate
Oil inject heat off
(A) (A) (A)
End of cycle
Drum rotate stop
Drum rotate fast
Food cooking

FIG 19


Selection of food
Selection of food basket
Fitted into food chamber
Door closed
Selection of food cycle
Moisture set
Temp set
Time set
Speed set
Automatic program
Start cycle
Monitor
Heat on
Drum Rotate
End of cycle
Monitor
Steam inject
Food cooking

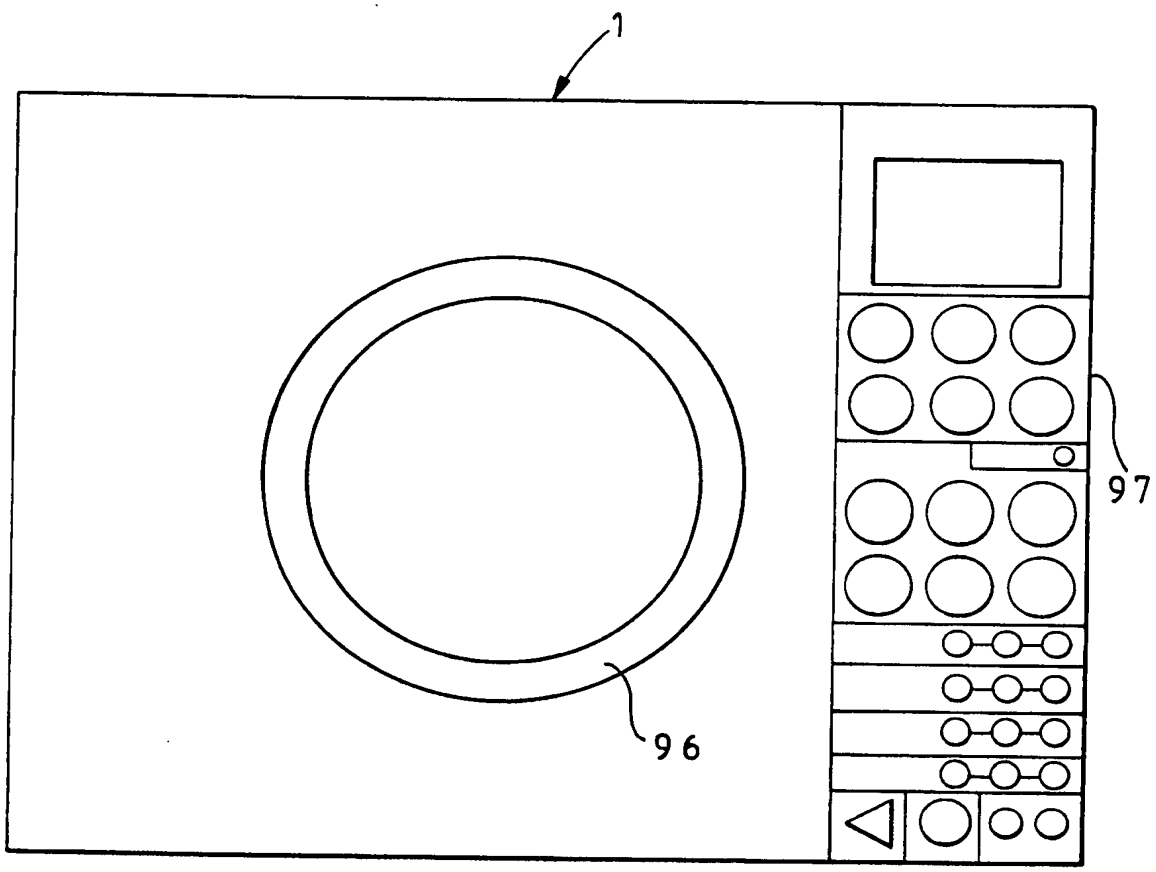


FIG 20

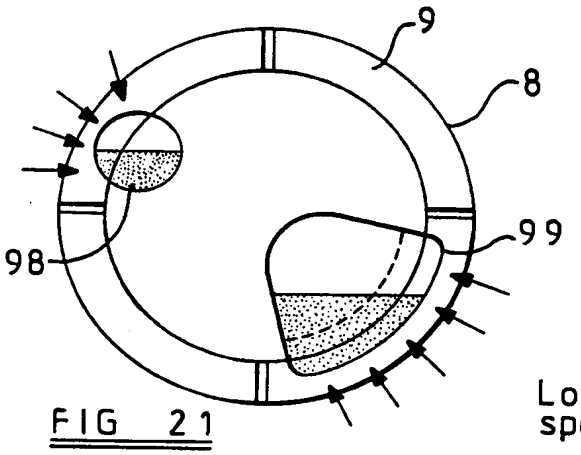
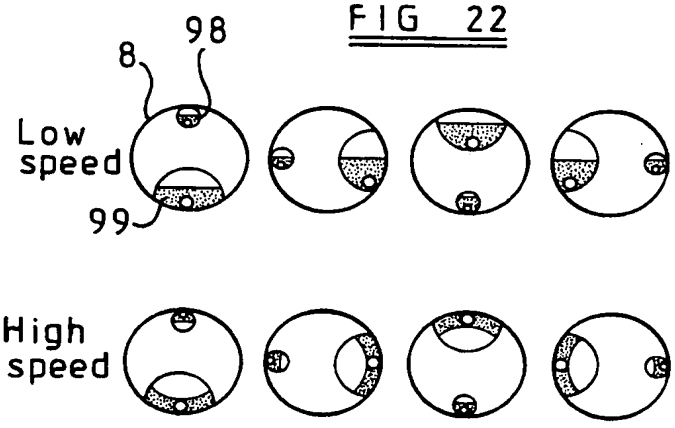


FIG 21

FIG 22



INTERNATIONAL SEARCH REPORT

Inter ..uonal Application No
PCT/GB 94/02064

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A47J39/00 A47J37/04 D06F25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A47J D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AT,A,190 024 (W. BÜSCHER) 25 May 1957	1-4,23, 29
A	see page 2, line 67 - line 78; figures 1,6	8
X	US,A,4 203 358 (H. VOGT) 20 May 1980	29
A	see claim 1; figures 1,2	1,3,4
X	WO,A,93 01741 (ELOMA GMBH BEDARFSARTIKEL ZUR GEMEINSCHAFTSVERPFLEGUNG) 4 February 1993	31-33
Y	see page 6, line 33 - page 7, line 20; figure 12	30
A	see page 15, line 16 - page 16, line 29; figure 13	11,12, 14, 18-20, 22,25-27

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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Date of the actual completion of the international search	Date of mailing of the international search report
24 January 1995	06. 02. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Schmitt, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte ..ional Application No
PCT/GB 94/02064

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,Y	WO,A,93 21809 (V. CAVALLO) 11 November 1993	30
A	see page 11, line 13 - line 31; figure 3	5,9
A	WO,A,93 18349 (B.H. HANSSON) 16 September 1993 see page 1, paragraph 5 - page 2, paragraph 1; figures 4,5	6
A	DE,A,29 17 635 (VEB KOMBINAT TEXTIMA) 10 January 1980 see claims 1,2; figure 1	23

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ..onal Application No
PCT/GB 94/02064

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AT-A-190024		NONE		
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		FR-A,B	2324269	15-04-77
WO-A-9301741	04-02-93	DE-A-	4124742	28-01-93
		AU-A-	2345292	23-02-93
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		EP-A-	0591510	13-04-94
		JP-T-	6508544	29-09-94
WO-A-9318349	16-09-93	SE-C-	501130	21-11-94
		EP-A-	0632875	11-01-95
		SE-A-	9200717	10-09-93
DE-A-2917635	10-01-80	NONE		